

Trionyx, and *Chitra*. *Emyda vittata* (Peters) is still found living in Ceylon, Southern and Central India. The new species are *Emyda lineata*, remarkable for the linear arrangement of its granular ornament; *Emyda sivalensis*, distinguished by being twice as large as the existing species; and *Emyda palaeindica*, also founded on fragments. *Trionyx* is represented by three species, of which one is referred to the *T. gangeticus* of Cuvier, and the other two are unnamed. Finally, the *Chitra indica* (Gray), which ranges from the Ganges to the Malay coast, completes the account of the tortoises from the Siwalik hills.

The Chelonia are one of the most neglected groups of extant reptiles, and hence any attempt to deal with the fossil forms encounters difficulties in requiring research into the variableness of existing forms, and the grounds for classifications which have been adopted. The opportunity for writing a monograph like that which we notice might perhaps have justified such research; but failing it, we can only express gratification that the materials in the British Museum are made known in this handsome form.

MISCELLANEOUS.

On the Question of the Existence of Different Plasma-layers in the Soft Body of the Rhizopoda. By Dr. A. GRUBER.

A QUESTION which has been frequently discussed is that as to the presence in the soft body of the Rhizopoda of separate plasma-layers, and the consequently more complex structure of those low Protozoa. The decision of this question is of interest because it is among the Rhizopoda that we have probably to seek the starting-point of the higher Protozoa, and because thereby it would be settled whether a unicellular organism may be competent to the performance of the most important physiological functions even if its protoplasm constitutes a perfectly unitary mass not separated into different regions, or whether this is not the case. I have here to state definitely that no division of the Rhizopod-body into zones sharply differentiated morphologically and physiologically occurs, and that the interpretations which have been made in this sense are decidedly founded upon illusions.

I will here mention only two authors who have gone furthest in this direction, and in the first place Maggi, who distinguishes not only an ecto- and an endoplasm, but also a mesoplasm*, in the last of which are seated the secretory organs of the Rhizopoda, namely the contractile vacuoles, while the ectoplasm has to serve for locomotion

* "Studi anatomico-fisiologici intorno alle Amibe, ed in particolare di una innominata," in Atti Soc. Ital. Sci. Nat. vol. xix. fasc. 4.

and the endoplasm for digestion. From the former therefore the pseudopodia originate; in the latter lie the incepted nutritive materials, and the nucleus is also contained in it.

Brass * goes still further, distinguishing in the Rhizopod-body, and, indeed, in the Infusoria and the animal-cell generally, four kinds of plasma, namely (proceeding from within outwards) the nutritive plasma, the food-plasma, the respiratory plasma, and the motor plasma. Brass's statements have already been sharply refuted by Bütschli †, and I may therefore here content myself with referring to this memoir, although it relates chiefly to the Infusoria. Bütschli's objections in fact, in my opinion, equally apply to the part of Brass's work which relates to the Rhizopoda.

Whoever has long busied himself with the study of the Rhizopoda knows how many species there are, especially among the *Amœbe*, in which, during life, no division into separate zones occurs—in which the whole of the contained bodies, as well as the nucleus and vacuoles, are irregularly whirled about, so that, for example, the nucleus or the nuclei may be at one time pushed to the extreme periphery, and then again flow back into the centre of the body. If in such Rhizopoda, after the application of any reagents, an apparent separation into different plasma-layers occurs, this may be definitely regarded as artificially produced, in the face of the conviction arrived at during the life of the animal. But even during life in many species, especially the tough ones, an apparent division at least into two layers is often to be observed; this, however, as stated, is only apparent, and is due to the fact that the granules and vacuoles of the plasma group themselves chiefly in the middle of the body, and do not easily make their way into the processes given off; in reality there is here also only a unitary plasma-mass, and the apparent stratification may disappear at any moment. In the shelled Rhizopoda also a formation of regions frequently occurs, produced in this way:—the granules and nutritive constituents occupy only the anterior or the middle part of the body, and the other parts then stand forth as hyaline zones; but here also there is no true stratification, for in division, as I have shown ‡, the whole of the plasma of both divisional halves is completely mixed together.

I may remark particularly that this conception of the Rhizopod-body does not rest merely upon my personal conviction, but that it was expressed long since by, among others, an English student of the Protozoa, Wallich §, and recently demonstrated positively by the most competent authority in this department, Bütschli ||, in

* 'Die Organisation der thierischen Zelle,' i. and ii.

† "Bemerkungen über die Schrift des Herrn Arnold Brass &c.," in *Morphol. Jahrb.* Bd. xi.

‡ "Der Theilungsvorgang bei *Euglypha alveolata*," and "Die Theilung der monothalamen Rhizopoden," in *Zeitschr. für wiss. Zool.* Bd. xxxv. and xxxvi.

§ *Ann. & Mag. Nat. Hist.* vols. xi., xii., and xiii. (1863-64).

|| Bronn's 'Klassen und Ordnungen der Protozoen,' pp. 98, 99.

Bronn's 'Klassen und Ordnungen des Thierreichs.' Bütschli asserts justly that in all marine Rhizopoda, the Perforata and a great part of the Imperforata, the entire soft body is composed of completely homogeneous plasma, and that in the Amœbæ and Monothalamia already mentioned by me no sharp line of demarcation exists between the hyaline ecto- and the granular endoplasm, "as indeed is clear from the fact that in certain Amœbæ, and also in *Pelomyxa*, in which usually no ectoplasm can be distinguished, under certain circumstances such a hyaline external plasma-layer makes its appearance, and this consequently must have been produced from the granular plasma in the same way in which, locally bounded, a hyaline pseudopodium is evolved from the body of a Rhizopod consisting of granular plasma."

I think I have now said enough upon this point, especially as I have gone into it in detail in a more complete memoir on Amœbæ * ; and I would here now only call attention to one thing, namely the external limitation of the Rhizopod-body. This, as is well known, is naked, therefore not surrounded by any cuticle ; but it would appear that by contact with water a stiffening of the plasma at the periphery takes place, preventing its deliquescence, and also causing an immediate closure of the cut surface in cases of artificial division. When the protoplasm issues forth in a broad process in the form of pseudopodia, the firmer bounding portion dissolves in the advancing plasma to become re-formed at the same moment. Usually this envelope is not perceptible even with the highest powers ; but in some Amœbæ, with a particularly tough slowly-flowing plasma, it frequently attains a demonstrable thickness. This opinion also I have put forward more in detail in previous writings, and I revert to it here chiefly because, in my first memoir relating to this point †, I overlooked, and in the second, while mentioning the fact ‡, I did not give it sufficient prominence that long before me Wallich § had set up and established exactly the same theory ; his view perfectly agrees with mine, and he has also given an explanation of the production of the nutritive vacuoles by assuming that a drop of water is carried in with the nutritive bodies, and that exerts the known stiffening action upon the portions of plasma surrounding the bodies, so that thus every nutritive vacuole appears to be lined with an ectosareal layer. I think it may be regarded as strong evidence in favour of the opinion here expressed that the English naturalist and myself have come to exactly the same result quite independently of each other.—*Biologisches Centralblatt*, Band vi. p. 5, March 1, 1886.

* "Studien über Amöben," in *Zeitschr. f. wiss. Zool.* Bd. xli.

† "Beitr. zur Kenntn. der Amöben," in *Zeitschr. f. wiss. Zool.* Bd. xxxvi. (1882); and see *Ann. & Mag. Nat. Hist.* ser. 5, vol. ix. p. 106.

‡ "Studien über Amöben," *l. c.* p. 190.

§ *Loc. cit.* Wallich, in a recently published criticism of my work, justly reproaches me with this sin of omission (*Ann. & Mag. Nat. Hist.* ser. 5, vol. xvi. p. 215).